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Syrphid flies in natural grass ecosystems of some areas of the Kraishte region (Bulgaria)

(Insecta, Diptera, Syrphidae)

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The structure of the syrphid communities in 6 natural grass ecosystems was studied. Basic population and cenotic characteristics – species composition, frequency of separate species, population density, dominant and trophical structure of the communities – were established.

Four species of the established ones are new for the studied region. The most favorable ecological conditions for the syrphid communities are in the ecosystem of Breznik, the most unfavorable in the ecosystem of Pernik.

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Introduction

This investigation is the second regional faunistic-ecological study on Syrphidae in the areas of Trun, Breznik, Divlya, Pernik, Kyustendil and Dupnitsa and deals with the natural grass ecosystems. In a previous study, Markova (1995) made an ecological analysis of the syrphid communities in different types of agroecosystems of the same region of Bulgaria.

Material and methods

The investigation was carried out in May, August, September and October 1990, and June, August and October 1991. Six natural grass ecosystems were studied. Their disposition is shown in Fig. 1.

The material was collected by "mowing" with a standard entomological sack. The number of samples taken from each ecosystem was 10 in 1990 and 20 in 1991. Each sample is the result of 50 mowing movements with an average length of 1 m.

Different population and cenotic indexes were used to evaluate the status of the syrphid cenoses. The taxonomic similarity, the similarity of population density of the species and the biocenotic similarity were evaluated after the classification of Zlotin (1975). The frequency of the species was determined after Bodenheimer and Balogh (after Dazho 1975), but the dominant community structure after Arzamasov et al. (after Hotko et al. 1982). The data were statistically processed in order to determine the total density of the syrphid flies. The biocenotic similarity was graphically presented by cluster analysis (after Pesenko 1982).

The region studied is mainly in the zone of the temperate continental climate (Tishkov 1982, Georgiev 1985). The rainfall of this region is characterized by summer maximum and winter minimum. The area of Kyustendil is an exception because it belongs to the transitional continental climatic zone

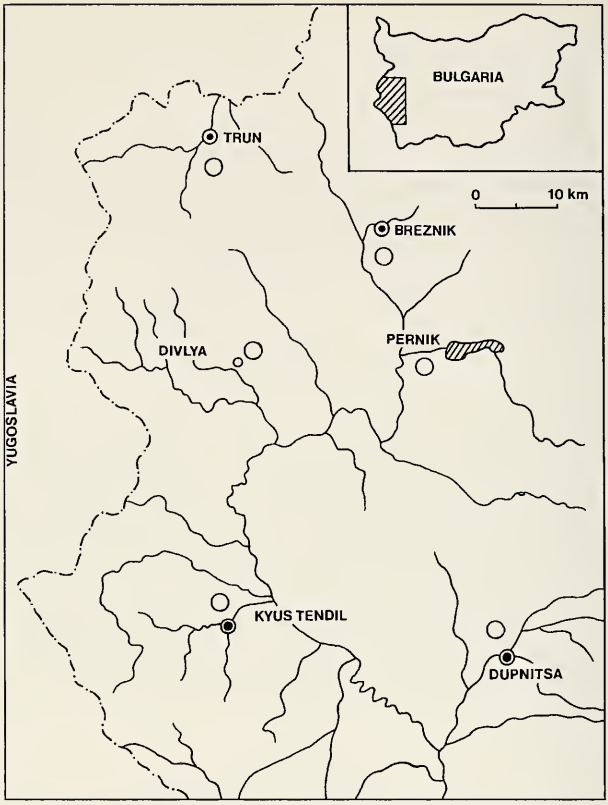

Fig. 1. Scheme of the investigated region and the ecosystems from which the material was gathered.

that is characterized by less rainfall during the spring and summer months in comparison with that of autumn and winter.

A certain difference between the Kyustendil are and the other studied areas is noted in accordance with the species composition of the natural grass ecosystems. The grass communities in the ecosystems studied in the areas of Trun, Breznik, Divlya, Pernik and Dupnitsa are composed of xeromesophytic and xerothermic grass formations of *Agrostis capillaris, Festuca valesiaca, Festuca stojanovii, Chrysopogon grylli* and others. The grass ecosystem studied in the area of Kyustendil is a mesophytic grass formation of *Poa silvicola* (Bondev 1991).

Results and discussion

As a result of the investigation, 22 species of syrphid flies were noted in 1990 and 18 species in 1991. The total number of recorded species is 26. 15 of them belong to subfamily Syrphinae and 11 species to subfamily Milesiinae. Together with the 6 species found by Nedjalkov (1912), the 6 species recorded by Drenski (1934), and the 24 species recorded by Markova the number of syrphid fly species reported for this part of Bulgaria is 36. Four species are new for the syrphid fauna in this region. They are marked with an asterix in the list below. For each species the numbers of the individuals per 1 ha are given in brackets behind the collection date. The recorded species are arranged after the classification of Vockeroth (for subfamily Syrphinae) and of Thompson & Hippa (for subfamily Milesiinae) after Peck (1988):

1. *Dasysyrphus lunulatus* (Meigen, 1822)*
Breznik (8/28/1990: 67).

2. *Episyrphus balteatus* (De Geer, 1776)
Trun (5/25, 8/28/1990: 67, 133 and 6/1, 8/3/1991: 100, 100); Breznik (5/25/1990: 67 and 6/1/1991: 133); Kyustendil (5/26/1990: 67 and 6/2, 8/4/1991: 133, 33).

3. *Metasyrphus corolae* (Fabricius, 1794)
Breznik (5/25, 8/28, 10/1/1990: 67, 133, 67 and 6/1, 8/3/1991: 33, 200); Divlya (8/27, 10/2/1990: 133, 200 and 8/3, 10/5/1991: 200, 100); Pernik (8/26/1990: 67 and 8/4/1991: 67); Kyustendil (8/30/1990: 267 and 6/2, 8/4/1991: 100, 100); Dupnitsa (8/25/1990: 133 and 6/2, 8/4, 10/6/1991: 33, 33, 33).

4. *Metasyrphus latifasciatus* (Macquart, 1829)
Breznik (8/28/1990: 67).

5. *Metasyrphus luniger* (Meigen, 1822)
Kyustendil (9/27/1990: 67 and 8/4/1991: 33).

6. *Sphaerophoria philanthus* (Meigen, 1822)
Dupnitsa (8/4/1991: 33).

7. *Sphaerophoria rueppelli* (Wiedemann, 1830)
Breznik (5/25/1990: 67); Divlya (8/27/1990: 67); Kyustendil (8/30/1990: 67 and 8/4/1991: 33).

8. *Sphaerophoria scripta* (Linnaeus, 1758)
Trun (5/25, 8/25, 10/1/1990: 200, 267, 400 and 6/1, 8/3, 10/5/1991: 233, 100, 200); Breznik (5/25, 8/28, 10/1/1990: 667, 200, 133 and 6/1, 8/3, 10/5/1991: 433, 233, 167); Divlya (5/28, 8/27, 10/2/1990: 200, 33, 133 and 6/1, 8/3, 10/5/1991: 167, 133, 67); Pernik (5/25/1990: 133 and 6/2, 8/4, 10/6/1991: 67, 167, 33); Kyustendil (8/30, 9/27/1990: 67, 67 and 6/2, 8/4, 10/6/1991: 100, 100, 33); Dupnitsa (5/27, 8/25/1990: 200, 267 and 6/2, 8/4/1991: 167, 67).

9. *Syrphus vitripennis* Meigen, 1822
Kyustendil (8/4/1991: 33).

10. *Melanostoma mellinum* (Linnaeus, 1758)
Trun (5/25, 8/28/1990: 133, 67 and 6/1, 8/3, 10/5/1991: 100, 100, 33); Breznik (5/25, 8/28, 10/1/1990: 200, 200, 67 and 6/1, 8/3, 10/5/1991: 100, 133, 133); Divlya (5/28/1990: 67 and 6/1, 8/3, 10/5/1991: 67, 33, 67); Pernik (8/26, 9/30/1990: 67, 67 and 6/2, 8/4, 10/6/1991: 33, 67, 33); Kyustendil (9/27/1990: 67 and 6/2, 8/4, 10/6/1991: 67, 100, 167); Dupnitsa (5/27/1990: 133 and 6/2, 8/4, 10/6/1991: 100, 33, 67).

11. *Platycheirus angustatus* (Zetterstedt, 1843)*
Breznik (8/28/1990: 67).

12. *Platycheirus immarginatus* (Zetterstedt, 1849)
Trun (8/28, 10/1/1990: 67, 67 and 10/5/1991: 67); Breznik (5/28/1990: 133 and 6/1, 8/3/1991: 100, 67).

13. *Platycheirus podagratus* (Zetterstedt, 1838)
Kyustendil (8/30/1990: 67).

14. *Paragus tibialis* (Fallén, 1817)
Trun (10/1/1990: 67 and 8/3/1991: 33); Breznik (10/1/1990: 267 and 6/1, 8/3, 10/5/1991: 33, 67, 167); Divlya (8/27/1990: 67 and 6/4, 8/3/1991: 133, 67); Pernik (8/4/1991: 33); Kyustendil (5/26/1990: 67).

15. *Paragus bicolor* (Fabricius, 1794)
Breznik (5/25, 8/28/1990: 67, 67 and 6/1, 8/3/1991: 100, 33); Divlya (8/27/1990: 67 and 8/3/1991: 33).

16. *Pipizella virens* (Fabricius, 1805)*
Breznik (5/25/1990: 67).

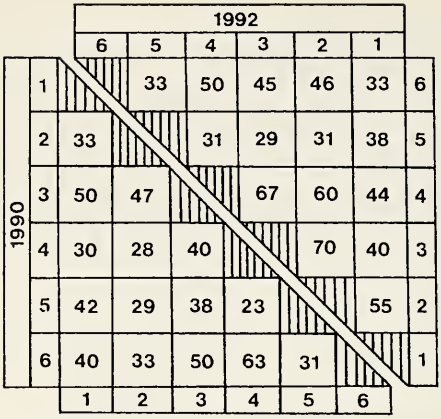

Fig. 2. Taxonomic similarity among the syrphid complexes in the investigated ecosystems. 1. Trun; 2. Breznik; 3. Divlya; 4. Pernik; 5 Kyustendil; 6. Dupnitsa.

17. *Cheilosia velutina* Loew, 1840
Kyustendil (8/4/1991: 33).

18. *Chrysogaster viduata* (Linnaeus, 1758)
Breznik (8/28/1990: 267 and 8/3/1991: 67); Pernik (5/25, 8/26, 9/30/1990: 67, 67, 67 and 6/2, 10/6/1991: 67, 33); Dupnitsa (5/27, 8/25/1990: 67, 67 and 8/4/1991: 33).

19. *Lejogaster metallina* (Fabricius, 1781)
Breznik (8/28/1990: 67).

20. *Orthonevra frontalis* (Loew, 1843)*
Pernik (5/25/1990: 67).

21. *Neoascia podagrica* (Fabricius, 1775)
Dupnitsa (6/2/1991: 33).

22. *Eumerus trigatus* (Fallén, 1817)
Kyustendil (8/30, 9/27/1990: 67, 67 and 8/4/1991: 33).

23. *Eristalinus sepulchralis* (Linnaeus, 1758)
Breznik (5/25/1991: 67).

24. *Eristalis arbustorum* (Linnaeus, 1758)
Trun (8/28/1990: 200 and 8/3/1991: 67); Kyustendil (5/26/1990: 200 and 8/4/1991: 133); Dupnitsa (8/25, 9/28/1990: 133, 133 and 6/2, 8/4, 10/6/1991: 67, 200, 67).

25. *Eristalis tenax* (Linnaeus, 1758)
Breznik (8/28/1990: 67 and 8/3/1991: 33); Divlya (10/2/1990: 133 and 8/3, 10/5/1991: 67, 67); Dupnitsa (9/28/1990: 67 and 8/4, 10/6/1991: 33, 67).

26. *Syritta pipiens* (Linnaeus, 1758)
Trun (8/28/1990: 67 and 8/3, 10/5/1991: 133, 100); Breznik (8/28, 10/1/1990: 133, 133 and 8/3, 10/5/1991: 133, 67); Divlya (8/27, 10/2/1990: 67, 67 and 8/3/1991: 167); Pernik (8/26/1990: 133 and 6/2, 8/4/1991: 100, 67); Kyustendil (10/6/1991: 100); Dupnitsa (5/27, 8/25, 9/28/1990: 67, 133, 67 and 6/2, 8/4, 10/6/1991: 100, 267, 67).

The species composition recorded in the natural grass ecosystems does not differ in qualitative aspect from that found in the agroecosystems in the same region (Markova 1995). The number of the common species is 22 and the taxonomic similarity is high: 79 %.

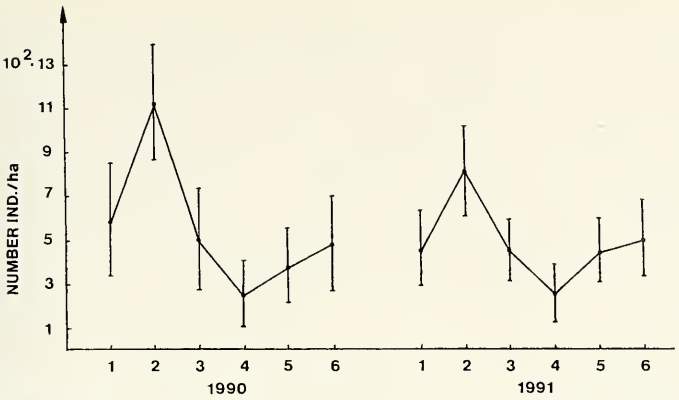

Fig. 3. Syrphid flies density in the investigated ecosystems. Vertical bars indicate 95 %, confidence intervals for arithmetic means. 1. Trun; 2. Breznik; 3. Divlya; 4. Pernik; 5. Kyustendil; 6. Dupnitsa.

In the different ecosystems the species number varies from 6 to 17 in 1990 and from 6 to 11 in 1991. For the whole investigation period the maximum species number is found in the ecosystem of Breznik, i.e. 17. The smallest number is that of the species established in the ecosystem of Trun and Pernik, i.e. 7 species in each of them. In the ecosystem of Kyustendil the species number is 13, in that of Dupnitsa 9, and in the ecosystem of Divlya 8.

It becomes clear that the most frequent species in the region studied in 1990 are *S. scripta* and *M. mellinum*. They are found in all ecosystems and in each sampling period. The same species in the region plus *S. pipiens* were established as constantly permanent only in 1991. Permanent species, i.e. species with frequency over 50 % of the ecosystems in both years of the investigation are *M. corollae* and *P. tibialis*. The rest of the species has a lower degree of frequency. In 1990 8 species are accessory and 9 species accidental; in 1991 6 species are accessory and 7 species accidental.

The differences among the species spectra of the syrphid flies in the examined ecosystems should be considered as a result of various frequency of the species. The taxonomic community of the syrphid complexes is, within similar limits, varying from 23 to 63 % in 1990 and from 29 to 70 % in 1991 (Fig. 2). The similarity is middle in both years in most complexes. The complex in the ecosystem of Kyustendil, however is outstanding, because its taxonomic similarity with the other complexes is very low. In 1990 the taxonomic similarity of this complex varied from 23 to 42 % and in 1991 from 29 to 38 %.

The average density of the syrphid flies in the examined ecosystems presented during the time of study is given in Fig. 3. In 1990 the density of the syrphid flies is within the limits of 244 ± 75 ind./ha to 1.133 ± 128 ind./ha, and in 1991 from 253 ± 60 ind./ha to 811 ± 101 ind./ha. During the whole investigation period the density in the ecosystem of Breznik is the highest and reliably larger (2-3 × in 1990 and 1.6-3.2 × in 1991) than that of the rest of the ecosystems. The density in the ecosystem of Trun is the second in 1990, but in 1991 the second is that in the ecosystem of Dupnitsa. The density in these ecosystems is reliably larger with the exception of Pernik. The differences in the density of the rest of the ecosystems are statistically negligible. In both years the density of the ecosystem of Pernik is proved to be the lowest. The same is also established for most of the agroecosystems studied by Pernik (Markova 1995).

A difference among the syrphid complexes in the various ecosystems is observed in accordance with the density of the populations of the species (Fig. 4). In 1990 the similarity among the different complexes according to population density is within the limits of 16 to 41 % as in 9 of the variants it is middle and in 6 of them low. In 1991 it varies from 26 to 46 % and is middle in all variants.

The number of the dominant species, i.e. the species with relative number ≥10 % is from 2 to 5 in the different ecosystems. Generally 9 species appear to be dominant, namely: *E. balteatus*, *M. corollae*, *S. scripta*, *M. mellinum*, *P. tibialis*, *E. strigatus*, *E. arbustorum*, *C. viduata* and *S. pipiens*. However, only a part of the main species has a considerable relative part from the total number of all individuals. In 1990 these are 3 species, i.e. 54.1 % from all individuals. *S. scripta* has the biggest relative significance: 32.7 %,

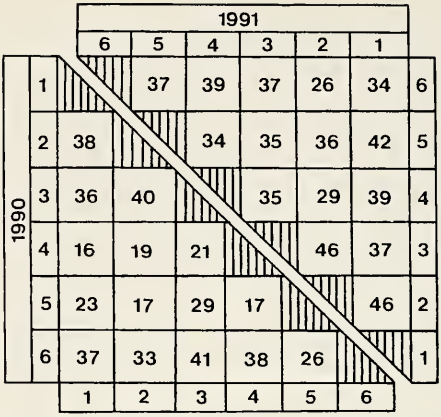

Fig. 4. Similarity among the syrphid complexes in the investigated ecosystems on the base of the population density. 1. Trun; 2. Breznik; 3. Divlya; 4. Pernik; 5. Kyustendil; 6. Dupnitsa.

followed by *M. corollae* and *M. mellinum* with 10.7 % each. In 1991 the main species with the highest degree of dominancy are 4 with generally 69.5 %. Arranged according to their relative part of total number of individuals these are the following: *S. scripta:* 28.1 %, *M. mellinum:* 16.3 %, *S. pipiens:* 14.8 % and *M. corollae*: 10.3 %, which means that these are the very same 3 species as in 1990 plus *S. pipiens*. *S. scripta* is a constantly dominant species in both years of investigation. It is accompanied by *M. mellinum in* 1991.

The similarity among the complexes of the main species is within close limits in both years: 14-50 % in 1990 and 29-60 % in 1991. In most of the variants the taxonomic similarity among the complexes of the dominants is middle as it was found in the evaluation of the taxonomic similarity among the whole complexes in the different ecosystems. A clear differentiation of a complex from main species is not observed.

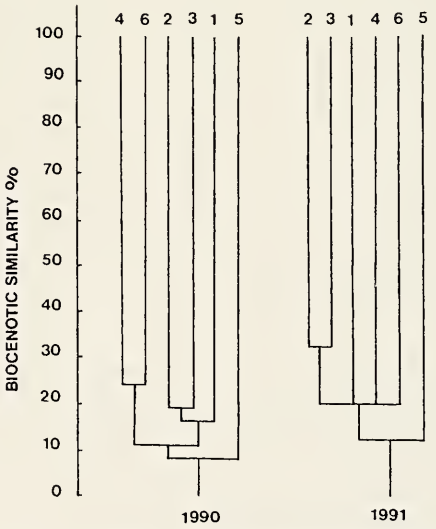

Fig. 5. Dendrogramme of the biocenotic similarity of the syrphid complexes in the investigated ecosystems. 1. Trun; 2. Breznik; 3. Divlya; 4. Pernik; 5. Kyustendil; 6. Dupnitsa.

An idea about the status of the syrphid cenoses in the different ecosystems is also presented by the integration index of Vainshtein. Summarizing the indexes for quantitative and qualitative similarity among the syrphid complexes it can be said that the index of Vainshtein varies from 4 to 24 % in 1990 in 1991 it is slightly higher and varies from 10 to 32 %. The extraordinary status of the complex in the ecosystem at Kyustendil is clearly seen especially considering the graphic expression of the biocenotic similarity shown in Fig. 5 with the help of cluster analysis. This determination is due to the climatic characteristics and the differences of the species composition of the natural grass ecosystem in the area of Kyustendil which affects directly and indirectly the qualitative indexes of the syrphid cenoses.

Considering the type of nutrition, the most recorded species belong to the group of the zoophages: 16 species. The saprophages are represented by e and the phytophages by only 2 species. The zoophages are 73 % of all individuals, the saprophages 26 %, and the phytophages only 1 %. *S. scripta* and *M. mellinum* predominate in the complex of zoophages and *S. pipiens* in the complex of saprophages mostly distributed in the region of investigation.

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